SCIENCE.

FRIDAY, JUNE 13, 1884.

COMMENT AND CRITICISM.

RARELY have all the conditions for abounding physical research been so admirably met; rarely has one so fortunate as to be in absolute command of such circumstances been removed in the very prime of life: but still more rarely has the unfinished work of a scientific man, called away under these relations, — only making the fate more inexorable, and the loss more sad, — fallen into hands so competent and appreciative as those of the late Dr. Henry Draper. His work on astronomical spectrum-photography has, since his lamented death in 1882, been reduced and discussed by Professor Young of Princeton, and Professor Pickering of Cambridge, and recently published in the Proceedings of the American academy of arts and sciences. We present in another column a notice of these researches, and may recall, in this connection, the second issue of *Science*, wherein the points of chief interest in the life of Dr. Draper, and the character, in outline, of the more important of his researches, were concisely dealt with. Notwithstanding his fondness for writing, the original published papers of Dr. Draper number only about a score; but many of them represent months, and in some cases years, of consecutive investigation. Had he been spared but a few years more, there can be little doubt that the world of science would, as has been said by one who knew him most intimately, have been enriched with a wealth of discovery almost unparalleled. The calamity of his death has been to some extent mitigated by the painstaking study of his spectrographic work which Professors Young and Pickering have made; Dr. Draper's method as an investigator being such that his death has rendered it possible for his co-workers to derive these results substantially as he would have done himself. To all scientific men engaged in original investigation, however, his sudden death must constitute a potent reminder of the desirability of publication proceeding almost simultaneously with research itself.

THE imminent danger of extinction which threatens many of the rare plants of the Swiss Alps has led to the formation of a society for their preservation. On reading the account of this society, presented in another column, the question naturally arises, Are any of *our* rarer species likewise in danger of extermination? With the exception of the extensive raids which are annually made upon some of our native plants by herb-collectors (and it must be understood that this business has assumed very considerable proportions, especially at the South), there are no very large drafts made which imperil the existence of the less common species. To be sure, in a few localities the mayflower and the climbing fern have been extirpated by the greed of collectors for the market; but it can hardly be said that these beautiful species are yet in peril. The same is true of the medicinal plants, ginseng and mandrake. It is fortunate that most species collected for medicinal purposes are reasonably prolific, and will doubtless hold out until those now in fashion have been discarded by other aspirants for popular and professional favor.

Nor are our rarer mountain-plants in any immediate peril. Those who have observed the difficulty apparently experienced by the attendants in White-Mountain hotels, in working up a 'boom' in dried plants, feel little apprehension that the localities will become exhausted. And it should further be noted, that our botanists who collect for exchange are generally very prudent in their use of the rarer species. There is, however, some danger lest the interesting localities where species are found somewhat out of place, so to speak, —

such, for instance, as magnolia at Gloucester, and great rose-bay at Sebago, — may be stripped of their treasures. These 'late-lingerers' possess great interest, and they should long be carefully guarded. But, so far as our rare plants in general are concerned, we do not yet need any society for their preservation: we do, however, need many local societies for their detection, and for critical study of their habits.

A year ago five commissioners of state water-supply were appointed by the New-Jersey legislature to select the best practicable plans for supplying the cities and towns of the state with pure and wholesome water. A report has recently been presented by them to the governor, on the capabilities of the Passaic-River basin for the collection and storage of water for the several centres of population that must now, or in the near future, depend upon it; and a plan elaborated by Mr. L. B. Ward, hydraulic engineer, is appended for the supply of Jersey City, Newark, and other neighboring municipalities. According to this plan, the waters of the Pequannock, a tributary of the Passaic, can furnish sixty million gallons daily, at an expense of two million dollars. With a further cost of three hundred thousand dollars, the supply can be increased to eighty million gallons, sufficient for all probable requirements for twenty years to come. Farther in the future, the Wanaque and Ramapo watersheds can yield an additional two hundred million gallons daily, so as to serve a population of two million eight hundred thousand souls. The chief danger of pollution in the Pequannock valley is of a modern kind: it comes from leakage of the Oil transit company's pipes that carry petroleum from the oil-wells of Pennsylvania to Jersey City; but this danger can be averted by state enactment. Mr. Ward's report contains a well-prepared contour-line map of the Pequannock basin, with darker and darker tints for every elevation of one hundred feet: this is reproduced from a more extended map, based on 'the valuable contoured maps of the New-Jersey geological survey,' and on special surveys by the commission in the adjacent part of New York. In view of the rapid growth of many of our cities, and of the increasing recognition of the value of a good water-supply, this fore-thoughtful action of the New-Jersey legislature should be imitated in other states.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Professor Tait on the reality of force.

The arguments by which Professor Tait seeks to disprove the objective reality of force, and to justify his advocacy of the exclusion of the term from scientific writing, occupy two and a half pages at the end of a seventy-four page article on mechanics, in the last edition of the Encyclopaedia Britannica. The vigor and confidence with which they are there stated, notwithstanding the author's treatment of forces as real entities in the body of the article, the character of the publication in which they appear, and the eminence of the Edinburgh professor in mathematics and physics, make them worthy of a careful examination.

In the first place, Professor Tait infers that force can have no such reality as matter has, because it is to be reckoned positively and negatively, — an action being opposed by a reaction, — while matter, or mass, is signless. This suggests two comments: 1°. The author never questions the objective reality of space and time, of which realities it is an essential feature, that, to every direction or interval A–B, an equal direction or interval B–A, of opposite sign, corresponds; 2°. The idea of a negative mass is not a self-contradictory one, and was once widely accepted. The element phlogiston was given up, not because of any absurdity in ascribing levity to material substance, but because a form of matter with positive mass (oxygen), capable of explaining all the phenomena, had been actually separated and identified.

Professor Tait's next criterion of objective reality is quantitative indestructibility, — an attribute shared by time, space, and matter, to which he adds energy. But the evidence of the indestructibility of energy is not of the same nature as that of the indestructibility of matter: for the latter, in all its forms, may be localized, and its density or elasticity measured; while the former, when stored up or 'potential,' cannot be shown to possess a single one of the properties of energy kinetic, or any existence in space, or any objective character whatever. Professor Tait virtually admits this difficulty, and awaits for its solution the discovery of some evidence 'as yet unexplained, or rather unimagined.' All strains and other actions of a clock-weight on its supports are obviously precisely the same — or impalpably somewhat stronger — with the weight wound up an inch as with it wound up a yard; and the existence of a greater 'potential energy' in the latter case is not to be found in the clock, but in the mind, which requires this expression as a form in which to put its conviction that a certain greater amount of work can be obtained. Even though it be admitted that there are no other intelligible terms in which this conviction can be stated, it is clear that the indestructibility of energy is an ideal and subjective truth, and cannot, therefore, be relied on as evidence of a reality distinctively 'objective.'